Opportunities for Bio-energy

GAS TECHNOLOGY INSTITUTE

> Independent Not-for-Profit R&D Organization
  - Labs, test facilities, library, classrooms, offices
  - 300,000 sq-ft facility on an 18-acre research campus
  - 350 employees (70% engineers and scientists

Major Lines of work

> Perform contract research, development and demonstration projects

> Manage technology development programs for others (e.g., energy industry, state agencies)

> Provide technical services for clients (performance and materials testing, technology and market assessment)

> Provide education and training (technical, institutional and business)

> Commercialize new energy related technologies through a variety of business arrangements

Commercialization and Intellectual Property Development

> GTI averages 20 – 25 technology licensing agreements annually

> Over 400 existing products have GTI developed technology

> GTI averages 20 – 25 patent applications annually

> GTI currently holds over 800 patents

Why is GTI interested in Renewable Energy?

For nearly 50 years, GTI has strategically pursued development of gasification technologies

> To ensure full-capacity utilization of gas supply infrastructure

> Extend the life of existing commercial natural gas resources and develop the technology base and infrastructure for sustainable supply of clean gaseous fuels.

Bio-mass Gasification Background

> Advanced Gasification of Biomass is Environmentally Sound

> Industry and Government Agencies may Cost-share Development

> gaseous fuels could be used at industrial sites with no access to natural gas.

Impact on Economy and Energy Security

> National commitment to develop fossil fuels during the first half of the 20th century has led to abundance of fossil fuels and economic prosperity during the latter half of the 20th century

> Similar commitment now in biomass can lead to energy prosperity during the latter half of 21st century

> In Illinois Corn Stover represents substantial opportunity for electricity production
  - 100 tons per day = 5MW
  - Midwest States potential 10 – 15 gigawatts

> Illinois Municipal Waste Water could provide approximately 2,000,000 MW hours of electricity.

> Applications/where feasible should use CHP systems to increase efficiency

IGCC Project in Andhra Pradesh, India

India IGCC Proces Design Basis

Skive Project, Denmark

Skive Project Design Basis

The Kokemäki Novel CHP Plant

- **Integrated to the existing Kokemäki district heating plant**
- **Fuel drying by waste heat from the plant**
- **Wood fuel**

- **Fuel capacity** **7200 kW**
- **Power output** **1800 kW_e**
- **District heat output** **4300 kW**
- **Heat output to the fuel dryer** **430 kW**

- **Plant commissioning underway**

Other Biomass Gasification Projects

GTI Gasification R&D Facility

- **GTI's State-of-the-Art Gasification Pilot Plant Test Platform**
- **Flexible Fuel Capability**
  - **Coal: ~ 10-20 tons/day**
  - **Biomass: ~ 20-40 tons/day**
- **Operational Flexibility**
  - **Pressure ~ 400 psig**
  - **Air/Oxygen Operation**
- **Plug and play systems integration and testing (Feed, Gasifier, Cleanup, End-use)**
- **Commissioned in Dec 04**

Flex Fuel Gasification R&D Facility

- **Solids feed system**
- **Gasifier**
- **Cyclones**
- **Gas conditioning unit**
- **Emissions & Controls**

Power from Animal Waste

What are the issues and opportunities?

Is your farm right for a

Waste to Energy system?

> Minimum size - 300 head of Dairy Cows or 2000 Swine (50kw)

> Predictable Manure Production
  – Are these animals in confinement year around
  – Does you animal population fluctuate by more than 20% a year.

> Manure should end up at one collection location

> Manure should be free of excess, bedding, sand, rocks and other materials

> Will need separator if sand bedding is prevalent

Is your farm right for a Waste to Energy system? Continued . . .

> Do you have a need for the energy and/or heat recovery?

> Is your manure compatible with bio-gas technology?
  – 2% to 10% bio-solids is best
  – How much water management is necessary?

> Can you. . .
  – Pay regular attention to system operations?
  – Provide necessary repairs and maintenance?

> Do you. . .
  – Have the desire to see the system succeed?

Utility Programs to encourage waste to energy deployment on farms

> Special rates to encourage electric production to help meet renewable portfolio standards

> Involvement with farmers to respond to federal RFP's for renewable energy grants
  > USDA
  > USDOE

> Utility Ownership of Energy Production Equipment on Farms

What will move this market?

> Education for Farmers, Utilities and businesses

> Realization of stricter future regulations

> Financial benefits for emissions reductions

> Advancements in waste to energy technologies and systems

> Investments by larger companies in systems development and deployment

> Commitment by CAFO operators and government

Observations (issues) regarding Status of Marketplace

> Unsophisticated systems deployment

> Minimal systems technology advancements occurring with Federal and State Grants

> Farmers like to “do it themselves”, least cost option almost always deployed

> Economics often based on exaggerated information regarding operational reliability and gas production

> Little or no movement to create “off the shelf” integrated systems (Closed loop system development crucial for emission credits and future regulations)